

**Summary Report of
BNL Occupational Medicine Clinic (OMC)
Medical Surveillance Examination Results
For
BNL Employees in
Fiscal Year 2006 (FY 2006)**

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Executive Summary

This report summarizes OMC's findings from 565 OSHA or DOE-mandated medical surveillance exams performed during Fiscal Year 2006 ("FY 2006") for BNL employees with potential occupational exposure to asbestos, beryllium, cadmium, lead and noise. Medical Surveillance examinations and clinical tests look for internal doses or early biological effects from these exposures. Results showed:

- **No detectable occupational overexposures or adverse health effects from current or recent exposure to asbestos, beryllium, cadmium or lead.**
- **2 instances of OSHA-recordable occupational hearing loss (referred to as a "Standard Threshold Shift" or "STS").**

Taken together, these results show that efforts at protecting BNL employees from workplace health hazards have, to date, been highly successful and continue to improve.

OMC is highly supportive of:

- **the current initiative led by Industrial Hygiene to obtain adequate baseline, site-wide, operation-specific environmental monitoring data for noise, airborne contaminants and other hazards. This will help guide medical surveillance programs and assure worker protection from health hazards.**
- **the concept that working safely should be a "core value" for workers both when they are at and away from BNL.**

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Introduction

In FY 2006, OMC performed OSHA-mandated medical surveillance examinations for BNL employees with potential occupational exposure to the following common workplace hazards: *asbestos, cadmium, lead and noise*. In addition, 2 DOE-mandated beryllium medical surveillance examinations were performed for employees with potential beryllium exposures. (See table in *Results* section below).

Medical surveillance is an important component of Integrated Safety Management, in that it provides assurance that the line organizations are adequately protecting their workers from workplace health hazards. Medical surveillance examinations of employees, including clinical testing, assess:

- 1) The internal dose of workplace substances (e.g.; blood lead and cadmium levels)
- 2) Early evidence of harm resulting from exposure to workplace hazards (e.g.; hearing loss from loud noise exposure; changes in chest x-ray or pulmonary function tests due to scarring of the lungs or their linings as a result of prior asbestos exposure)

Data generated by medical surveillance examinations provide valuable feedback to line and support organizations on the effectiveness of BNL worker health protection programs directed at protecting BNL workers from overexposure to hazards or deleterious health effects resulting from these hazards.

Confidentiality statement: Because this report includes the results of clinical tests, personal identifiers have been removed, and no information on personal medical conditions is reported, in order to protect worker privacy and confidentiality.

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METHODS

OMC performs the types of medical surveillance exams included in this report in response to a request for such surveillance communicated to OMC from a line organization through an [Additional Medical Surveillance Form \(AMS\)](#) completed by an employee's supervisor and ES&H Coordinator. Surveillance exams are performed in compliance with OSHA or DOE medical surveillance requirements included in OSHA or DOE standards pertaining to workplace hazard control. Generally, exposure at or above a specified regulatory Action Level for a specified duration triggers a required medical surveillance examination. For instance, medical surveillance under the OSHA Lead General Industry Standard, 29CFR1910.1025, is triggered by exposure to lead at or above the OSHA Action Level of 30 ug/m³ (8 hours time weighted average) for more than 30 days per year.

Components of a medical surveillance exam may include: a focused occupational and health history, a physical examination and appropriate clinical tests, which can include blood tests, urinalysis, chest x-ray, or spirometry (pulmonary function testing), depending upon the exposure and potential organ toxicity. Most of these tests are performed in-house at OMC, but blood and urine samples are analyzed at a licensed commercial laboratory; chest x-rays are sent out for interpretation by a Board Certified radiologist.

OMC medical surveillance exams and results are recorded in hard copy OMC medical records and electronically through Occupational Health Manager ("OHM"), a proprietary electronic medical records software package specifically designed for occupational medicine practices. OHM has the capacity to generate individual or summary reports of medical surveillance exams based upon data previously entered. These reports are the basis of the summary report presented here.

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RESULTS

The following table displays the numbers medical surveillance exams performed at BNL by OMC in FY 2006, by department/division and by type of surveillance:

Department/ Division*	SURVEILLANCE TYPE						Totals by Dept./Div
	Asbestos	Beryllium	Cadmium	Lead- Construc- tion	Lead- General Industry	Noise	
AD					1	106	107
AM						4	4
BO				1			1
DA		1				1	1
DF					1	1	2
EM						25	25
EP	4			77		206	287
ES						4	4
HP	1			6		5	12
IA						1	1
IO						2	2
LS					1		1
PO						1	1
PE						1	1
PG						2	2
PM						1	1
RP			1		5	24	30
SC				2		20	22
SE					3	32	35
SS				3		8	11
WM				6	1	7	14
Totals by Surveillance Type	5	1	1	95	12	451	
						Grand Total	565

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SPECIFIC SURVEILLANCE PROGRAMS AND RESULTS

Asbestos

Background

The chief organ toxicity from asbestos is the lung. Asbestos exposure via the respiratory route can affect the lung itself or its lining (the pleura). There is a long latency between exposure and disease outcome, generally exceeding 15 years. Asbestos-induced scarring (“fibrosis”) of actual lung tissue is referred to as asbestosis. Effects on the pleura, or lung lining, include pleural thickening, pleural plaques (focal areas of thickening) and mesothelioma (malignant pleural tumor). Asbestos exposure has also been associated with increased lung cancer risk, especially in smokers.

Asbestos work at BNL has been determined to fall under the OSHA Asbestos Construction Standard (29CFR1962.1101). This standard requires medical surveillance exams for workers exposed at or above the OSHA time-weighted average (TWA) or excursion limits for airborne asbestos fibers. Clinical testing includes chest x-rays on a schedule recommended by the OSHA standards, and spirometry (pulmonary function testing) to detect any impairment of lung function.

ASBESTOS RESULTS:

5 BNL employees received asbestos medical surveillance because of potential asbestos exposure as a result of insulation work, asbestos abatement and monitoring of asbestos work. These workers included 5 EP employees and one industrial hygienist.

- **In 4 workers, there were no findings consistent with asbestos-related lung disease.**
- **The remaining worker had been diagnosed in 1991 with mild asbestosis based upon a chest x-ray, apparently as a result of asbestos exposure in the military in the early 1970’s. This worker showed no progression of this pre-existing asbestosis based upon x-ray findings, and has normal lung function.**

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Beryllium

Background

Exposure to the metal beryllium, especially through inhalation of fine beryllium particles, can result in allergic-type sensitization in genetically predisposed individuals. Sensitized individuals are at risk of developing chronic beryllium disease (CBD), a condition in which expanding round scars (“granulomas”) can arise in the lungs and, in severe cases, can cause disability or even death due to respiratory compromise.

At BNL, beryllium has had limited uses in reactors and accelerators. For this reason, handling and machining of beryllium metal and beryllium alloys has been very limited at BNL. In addition, in recent years, BNL has maintained very tight beryllium exposure controls, preventing significant worker exposure in tasks such as the installation of beryllium tubes in the RHIC detectors during construction in 1999-2000. In FY 2006, two current BNL employees have been identified by Industrial Hygiene as having had beryllium exposure in the past at BNL. These employees are classified as “Beryllium Associated Workers” according to the DOE Federal Regulation 10CFR850 *Chronic Beryllium Disease Prevention Program* (1999), and are offered beryllium medical surveillance every three years. This is directed at the detection of beryllium sensitization (through a special blood test called the BeLPT) and CBD through chest x-ray and spirometry.

A previous round of beryllium medical surveillance of 4 current and 16 former BNL employees in 2000-2001 yielded no instances of beryllium sensitization or CBD.

A second round of beryllium medical surveillance was performed largely during FY 2005. At that time, one employee, a technician at AD, was found to be sensitized to beryllium, based upon 2 abnormal BeLPT tests. Fortunately, he was healthy and showed no signs of CBD. The employee’s beryllium exposure while at BNL had been trivial and he worked at a prior occupation where he may have been beryllium-exposed, so a causal link was not established between this employee’s beryllium sensitization and his work at BNL. This employee has subsequently retired and will continue to be followed under DOE’s beryllium medical surveillance program for former workers.

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BERYLLIUM MONITORING RESULTS

1 out of the 2 beryllium-associated workers consented to beryllium medical surveillance. (In accordance with the DOE Beryllium Standard, beryllium medical surveillance is voluntary.)

This worker showed no evidence of beryllium sensitization or chronic beryllium disease.

Cadmium

Background

The heavy metal cadmium has been associated with lung and kidney toxicity and increased lung cancer risk. The major route of entry of concern is inhalation of airborne cadmium particulates. Parenthetically, cigarette smoke is a non-occupational source of cadmium internal dose.

At BNL, significant exposure to cadmium is rare. Certain types of shielding contain cadmium, so there is potential for cadmium exposure from cadmium-containing dusts from such shielding when it is stored or manipulated.

The OSHA Cadmium Construction Standard (29CFR1926.1127) requires initial cadmium medical surveillance, followed by a second round of cadmium surveillance one year after the initial round, even where exposure has ceased, because cadmium can have delayed biological effects.

Cadmium medical surveillance consists of obtaining blood and urine cadmium levels and comparing these results to OSHA biological exposure indices (BEI), which are threshold values for blood and urine tests. Exceedance of these thresholds indicates overexposure to cadmium. Urine beta-2 microglobulin is also checked; elevated levels suggest the possibility of kidney damage due to cadmium exposure, resulting in leakage of the small beta-2-microglobulin protein into the urine.

Prior cadmium medical surveillance at BNL has not, to date, shown any evidence of cadmium overexposure or toxicity.

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CADMIUM MONITORING RESULTS:

- **One employee from RP received an initial round of cadmium medical surveillance for current or recent cadmium exposure. Blood and urine cadmium concentrations were well within the acceptable range and beta-2-microglobulin testing detected no evidence of kidney damage.**

Lead

Background

Lead can adversely affect a number of organ systems, including the neurological, renal (kidney) and hematological (bone marrow and blood) systems. Respiratory exposure to airborne lead particulates or metal fume is of the greatest concern. Ingestion during eating or smoking in the workplace is also a concern absent proper hand washing and hygiene.

At BNL, potential sources of lead exposure include: lead shielding—production of airborne particulates when the shielding is handled, cut or otherwise worked, especially if oxidized; lead dust at the firing range; removal or disturbance of old lead paint; and lead solder—less of a problem now since modern solders have reduced percentages of lead.

Most lead-exposed BNL employees receive medical surveillance under the OSHA Lead Construction Standard, 29CFR1926.62. Some fall under the OSHA Lead General Industry Standard 1910.1025. At a minimum, OSHA mandates that lead medical surveillance include a blood lead level (BLL) and red blood cell zinc protoporphyrin (ZPP). Additional examinations and testing are performed as indicated or mandated by OSHA. The BLL reflects recent lead exposure.

- A BLL of 40ug/dL or higher is considered to indicate lead overexposure and the possibility of organ toxicity. Work removal is mandated under both OSHA standards for a BLL at or above 40 ug/dL.
- ZPP is a hemoglobin precursor which builds up in red blood cells when hemoglobin production is inhibited by the presence of lead. ZPP may give some indication of lead exposure during the prior 4 months, since the average red blood cell remains in circulation for 4 months.
- At BLLs typically observed in BNL workers, ZPP is a poor measure of prior lead exposure because the test is very non-specific, and can be elevated for other reasons, including inhibition of hemoglobin production due to iron-deficiency anemia. For this reason, ZPP results are not reported here beyond the general statement that nearly all BNL FY 2006 ZPP results fell within the normal range.

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In the few instances where ZPP was found to be elevated, alternate medical reasons were found.

In past, occasional instances of elevated blood lead levels have been detected among BNL employees. Without exception, these have been traced to lead exposure in the course of hobbies, rather than to lead exposure during work at BNL. Bullet-making and extensive shooting at firing ranges have been significant non-occupational exposures.

SURVEILLANCE RESULTS

OSHA Lead Construction Standard;

A total of 95 employees received blood lead tests under the OSHA Lead Construction Standard. Most employees (77) worked for EP.

The range of BLL's was from <1 ug/dL to 6.4 ug/dL, except for one outlier, an LS employee with a BLL of 23.1 ug/dL. It was subsequently established that this employee had non-occupational lead exposure associated with a hobby and had a level of 30.7ug/dL 5 months prior. Two LS co-workers engaged in similar work had BLL's within normal limits. The worker with the high BLL has been advised to avoid non-occupational lead exposure and continue to have his BLL checked periodically.

OSHA Lead General Industry Standard

A total of 12 employees had blood lead monitoring under the OSHA Lead General Industry standard. Median blood lead level (BLL) was 2.6 ug/dL, with little variation among divisions/departments.

Noise

Background

A worker with occupational noise exposure at or above the OSHA Action Level is required to undergo audiometric testing (hearing tests) on an annual basis, for the early detection of noise-induced hearing loss. The worker's initial test under the OSHA Occupational Noise Standard (29CFR1910.95) serves as a baseline. Occupational hearing loss detected in subsequent years and meeting or exceeding a threshold (≥ 10 decibels [dBA] averaged over 2, 3 and 4 kHz in either ear) is referred to as a "Standard Threshold Shift" ("STS") and must be recorded by the employer on the OSHA 300 Log.

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Noise Medical Surveillance Results

OMC performed 451 OSHA hearing tests on employees in FY 2006. Two OSHA recordable case of occupational hearing loss (or “STS”) was detected.

Among the employees with work-related STS’s in FY 2006, one was a refrigeration engineer in EP and another was a senior technician at C-AD.

Summary and Discussion

- Medical surveillance results indicate that work planning and exposure control measures have been highly successful at protecting BNL workers from workplace health hazards and from adverse health effects from these hazards.
- No occupational overexposures or adverse health effects were found for asbestos, beryllium, cadmium or lead. Blood lead levels (BLLs) remain low, and are not significantly different from those recorded in FY 2005.
- The employee, who had a BLL of 30.6 ug/dL in 2005, was found to have a hobby associated with lead exposure. His BLL declined to 23.1 ug/dL after he curtailed the hobby. He will continue to be monitored.
- Temporal Trends (2004-2006)

OMC has written summary medical surveillance reports for CY 2004 and FY’s 2005 and 2006. The following temporal trends can be summarized:

- Excellent control of exposure to workplace health hazards throughout that time interval, with no cases of asbestos-related disease, lead or cadmium overexposure or toxicity attributable to BNL exposures.
- Just one case of beryllium sensitization, occurring in FY 2005 and of uncertain relationship to workplace exposures at BNL.
- A sharp decline in the number of OSHA STS’s (occupational hearing loss) between CY 2004 and FY 2005—from 7 down to 1, with 2 reported in FY 2006. We do not believe that the 2006 data point indicates a real reversal in the overall downward trend in STS’s, but we will continue to monitor this going forward.

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Recommendations

- OMC is highly supportive of the current initiative being led by Industrial Hygiene to get adequate baseline, site-wide, operation-specific workplace exposure monitoring for noise, airborne contaminants and other hazards. This will provide better guidance in determining who needs medical surveillance, and will provide further assurance that workers are being adequately protected from workplace health hazards.
- OMC supports continued efforts at controlling noise exposure at BNL. Great progress has been made in this area, as evidenced by the remarkable decline in the number of Standard Threshold Shifts (OSHA-recordable noise-induced hearing loss) between CY 2004 and FY 2005, with STS numbers remaining low in FY 2006.
- OMC encourages employees to bring their safe work practices with them when they work or engage in hobbies outside of BNL. As noted, the employee with the atypically high blood lead level had lead exposures traceable to hobbies—shooting at a firing range and making homemade bullets.

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